U. S. NUCLEAR REGULATORY COMMISSION

REGION III

Report No. 50-331/89001(DRP)

Docket No. 50-331 License No. DPR-49

Licensee: Iowa Electric Light and Power Company
IE Towers, P. O. Box 351
Cedar Rapids, IA 52406

Facility Name: Duane Arnold Energy Center

Inspection At: Palo, Iowa

Inspection Conducted: December 14, 1988 through January 25, 1989

Inspectors: M. Parker

H. Peterson

Approved By: for W. J. Apley
I. N. Jackiw, Chief
Reactor Projects Section 2B

2/10/89
Date

Inspection Summary

Inspection on December 14, 1988 through January 25, 1989 (Report No. 50-331/89001(DRP))

Areas Inspected: Routine, unannounced inspection by the resident inspectors of regional requests; on-site followup of events at operating power reactors; operational safety; maintenance; surveillance; plant trips; plant startup from refueling/startup testing-refueling; installation and testing of modifications; confirmatory action letter; cold weather preparations; verification of containment integrity; and report review.

Results: During this inspection period, the licensee completed its extended refueling outage and performed a plant startup. During this startup the licensee experienced several problems which prolonged the startup: a pinhole leak in recirculation loop drain line, High Pressure Coolant Injection (HPCI) turbine failure, main turbine high vibration and a wiped bearing on the main generator exciter (see Section 3). After resolving these startup problems, the plant operated for approximately two weeks when an Electro-hydraulic Control (EHC) system leak caused the plant to manually scram (see Sections 3 and 5). The licensee was able to resolve these difficulties and the plant was returned to operation. Several other major issues were followed during this inspection: completion and testing of the Low Pressure Coolant Injection-Loss of Off-Site Power (LPCI-LOOP) Loss of Coolant Accident (LOCA) swing bus

modification and subsequent closure of the associated Confirmatory Action Letter (CAL), startup testing, verification of containment integrity, drywell housekeeping/cleanliness and cold weather preparation. The licensee has been responsive to NRC concerns and has adequately cooperated in providing information for the following up of the plant events. No violations were identified.

DETAILS

1. Persons Contacted

R. Anderson, Assistant Operations Supervisor
*P. Bessette, Licensing
J. Bjorseth, Maintenance Engineering Supervisor
A. Browning, Group Leader, Nuclear Licensing
*P. Collingsworth, Quality Assurance - TOSS
W. Douglass, Technical Support Engineer
*G. Ellis, Plant Service Superintendent
D. Englehardt, Security Supervisor
D. Fowler, Operations Shift Supervisor A
H. Giorgio, Radiation Protection Supervisor
R. Hannen, Plant Superintendent, Nuclear
B. Lacy, Maintenance Superintendent
*R. Lessly, Manager - Design Engineering
C. Mick, Operations Supervisor
L. Miller, Technical Support Engineer
W. Miller, Supervising Engineer, Engineering Projects
N. Petersen, Licensing-IELP
J. Probst, Technical Support Engineer
*K. Putnam, Technical Support Engineer
*W. Rothert, Manager, Nuclear Division
*R. Salmon, Technical Services Superintendent
*J. Thorsteinson, Technical Support Supervisor
G. Van Middlesworth, Assistant Plant Superintendent, Operations
K. Young, Assistant Plant Superintendent, Radiation Protection/Security

NRC

*M. Parker, Senior Resident Inspector, NRC
*H. Peterson, Resident Inspector, NRC

In addition, the inspector interviewed other licensee personnel including Operations Shift Supervisors, Control Room Operators, engineering personnel, and contractor personnel (representing the licensee).

*Denotes those present at the exit interview on February 2, 1988.

2. Regional Requests (92701)

As a result of concerns expressed at the Fermi Plant, the resident inspectors were requested to review and followup the licensees response to Information Notice (IN) 87-12 and to provide information on any known failures of GE AKF-2-25 breakers. The concern is related to failures at facilities that use the reactor recirculation pump motor-generator's field breaker to accomplish the Recirculation Pump Trip (RPT) function, specifically GE AKF-2-25 breakers.

Review of IN 87-12 and the licensees response determined that the licensee has two applications of GE AKF-2-25 breakers: 1) the main generator field breaker and 2) the recirculation pump motor-generator breakers. However, the DAEC application does not utilize the GE AKF-2-25 field breakers for Recirculation PUMP Trip (RPT) or Anticipated Transient Without Scram (ATWS). The RPT/ATWS function at DAEC utilizes the generators output breaker for this purpose, which is not a GE AKF-2-25 breaker.

Review of GE AKF-2-25 maintenance history determined that three maintenance action requests (MARs) had been generated to repair these breakers. During an annual inspection of the main generator field breaker in 1987, a damaged eccentric bushing was discovered. This resulted in inspection of the recirculation pump motor-generator output breakers which were found to have cracked eccentric bushings. All three breakers were subsequently removed and sent to the manufacturer for repairs.

Review of the licensees response to IN 87-12 and GE Service Information Letter (SIL) has determined that the licensee is complying with both the IN and the SIL recommendations. This included performing appropriate maintenance with properly trained and qualified personnel, and the use of the specified grease during maintenance.

3. On-Site Followup of Events at Operating Power Reactors (93702)

During the inspection period, the licensee experienced several events, some of which required prompt notification of the NRC pursuant to 10 CFR 50.72. The inspectors pursued the events onsite with licensee and/or other NRC officials. In each case, the inspectors verified that the notification was correct and timely and, if appropriate, that the licensee was taking prompt and appropriate actions, that activities were conducted within regulatory requirements, and that corrective actions would prevent future recurrence. The specific events are as follows:

December 20, 1988 - 'A' Recirculation Pump Trip and Actuation of LPCI LOOP Select Logic

December 22, 1988 - Pinhole Leak Identified on a 2 inch Drain Line Elbow from the 'B' Recirculation LOOP

December 25, 1988 - HPCI Turbine Failure to Reach Rated Flow Within 25 Seconds

December 26, 1988 - Turbine High Vibration and Bearing Wipe

January 18, 1989 - Electro-hydraulic Control (EHC) System Oil Leak and Manual Scram

a. On December 20, 1988, while performing surveillance test procedure (STP) 42B011, LPCI Trip System Logic Functional Test and Timer Calibration, the licensee experienced a trip of the 'A' Recirculation pump and subsequent LPCI and recirculation system

valve realignment. The LPCI LOOP Select logic tripped the 'A' Recirculation pump due to an error in the STP. Initially, the STP did not allow performance of the test with the reactor recirculation pumps in service. However, the licensee performed a technical review to allow performance of the STP with the recirculation pumps in operation. This revised STP introduced an error which allowed the loop select logic to actuate following an unexpected adjustment of the recirculation pump speed by the reactor operator. The actuation allowed the valves to reposition but prevented the LPCI pumps from starting. The licensee initially reported this event approximately six hours after its occurrence. After further review of NUREG 1022, Supplement 1, the licensee, on January 19, 1989, subsequently downgraded the event to a non-reportable event.

b. On December 22, 1988, while conducting visual inspections of reactor coolant piping and valves as part of a reactor coolant system leak test, the licensee discovered a pinhole leak on a two-inch drain line from the B recirculation loop. The leak was identified to be coming from a weld boundary on an elbow pipe. The licensee believes the cause was thermal fatigue based on the lack of any spotting or residue on either the piping or the insulation which covered it and that the leak is at the edge of a weld on an elbow in a thermal expansion loop in the drain line. The licensee is cutting out and replacing the affected piping which will be retained for analysis to ensure that the cause is positively identified.

c. On December 25, 1988, while performing the HPCI surveillance test for operability at 150 psig reactor pressure, the HPCI turbine failed to come up to rated flow within 25 seconds. The problem was determined to be a procedural error and the HPCI test was satisfactorily re-performed. The licensee subsequently downgraded the event to a non-reportable event.

d. On December 26, 1988, at approximately 15% reactor power, the plant experienced high bearing vibration on the main generator bearings No. 7 and 8 during the initial main turbine roll. Necessary balancing was performed by G.E. on December 27, 1988. During a final turbine run, indications of steam leakage into the turbine casing and high vibration on bearing 9 were identified. The licensee, on December 28, 1988, commenced a reactor shutdown to perform repairs and to investigate the steam leakage. Disassembly of the bearing identified that bearing 9 was completely "wiped", with soft bearing babbit material being partially melted and displaced, and that bearing 10 sustained slight damage of the babbit material on the lower half of the bearing. On January 1, 1989, the licensee completed replacement of bearing 9 and 10.

The licensee, with the assistance of G.E. and an outside bearing expert from PME Inc., performed a root cause analysis. The probable cause was identified to be the long coastdown time of the turbine and/or rubbing of the inner oil deflector creating excessive heat buildup and bowing of the shaft. Further investigation revealed that the oil deflector was improperly installed after maintenance.

On January 3, 1989, the licensee performed corrective actions necessary to minimize the possibility for recurrence, including lube oil piping inspection and a complete turbine lube oil flush and sampling. The licensee recommenced reactor startup and subsequent testing of the turbine on January 5, 1989.

e. On January 18, 1989, an oil leak developed in a Flexonics hose in the EHC system to a turbine control valve (CV-3). The operators, fearing the loss of pressure for the bypass valve control, reduced reactor power with control rods and recirculation flow; and then manually scrammed the reactor. Through alert operator action, the plant was taken to hot shutdown without the use of RCIC, HPCI, or the lifting of a relief valve. The Flexonics hoses were installed to replace hard piping during the refuel outage due to industry concerns. The flex hose failure was believed to be due to a misapplication of the Flexonics hose. The licensee replaced all 43 high pressure Flexonics hoses with Aeroquip hoses. The plant was returned to operation on January 24, 1989.

No violations or deviations were identified in this area.

4. Operational Safety Verification (71707) (71710)

The inspectors observed control room operations, reviewed applicable logs and conducted discussions with control room operators during the inspection. The inspectors verified the operability of selected emergency systems, reviewed tagout records and verified proper return to service of affected components. Tours of the reactor building and turbine building were conducted to observe plant equipment conditions, including potential fire hazards, fluid leaks, and excessive vibrations and to verify that maintenance requests had been initiated for equipment in need of maintenance. The inspector by observation and direct interview verified that the physical security plan was being implemented in accordance with the station security plan.

The inspector observed plant housekeeping/cleanliness conditions and verified implementation of radiation protection controls. During the inspection, the inspector walked down the accessible portions of the RHR, Core Spray and HPCI systems to verify operability by comparing system lineup with plant drawings, as-built configuration or present valve lineup lists; observing equipment conditions that could degrade performance; and verified that instrumentation was properly valved, functioning, and calibrated.

These reviews and observations were conducted to verify that facility operations were in conformance with the requirements established under technical specifications, 10 CFR, and administrative procedures.

No violations or deviations were identified in this area.

5. Monthly Maintenance Observation (62703)

Station maintenance activities of safety related systems and components listed below were observed/reviewed to ascertain that they were conducted in accordance with approved procedures, regulatory guides and industry codes or standards and in conformance with technical specifications.

The following items were considered during this review: the limiting conditions for operation were met while components or systems were removed from service; approvals were obtained prior to initiating the work; activities were accomplished using approved procedures and were inspected as applicable; functional testing and/or calibrations were performed prior to returning components or systems to service; quality control records were maintained; activities were accomplished by qualified personnel; parts and materials used were properly certified; radiological controls were implemented; and, fire prevention controls were implemented.

Work requests were reviewed to determine status of outstanding jobs and to assure that priority is assigned to safety related equipment maintenance which may affect system performance.

The following maintenance activities were observed/reviewed:

Emergency Diesel Generator 'A' Lube Oil Changeout

Troubleshooting of Main Turbine Vibration and Bearing Replacement

Electro-Hydraulic Control (EHC) System Troubleshooting

Safety/Relief Valve PSV-4402 Leak Repair

Following completion of maintenance on the Main Turbine, EHC System, and the safety relief valve, the inspector verified that these systems had been returned to service properly.

a. On January 18, 1989, the reactor was manually scrammed due to an oil leak in the EHC system. The leak was identified to be in a Flexonics hose to a turbine control valve, CV-3. The licensee determined that the cause of the failure to be the misapplication of the Flexonics type hose. The licensee replaced 43 high pressure Flexonics hoses with new Aeroquip hoses. The inspectors followed the licensee's maintenance actions and observed good licensee Quality Control (QC) coverage. Two licensee QC inspectors were assigned to observe the maintenance work using step-by-step procedures. Internal cleanliness control was adequately maintained throughout the system repairs and hose preparation/hydro.

b. On January 24, 1989, following the EHC hose replacement and safety/relief valve (PSV-4402) leak repair, the reactor was started up and declared critical at 8:30 a.m. (CST). The safety/relief valve maintenance required adjustment of the valve flange to stop

minor steam leakage. This required the performance of a Class 1 System Leakage Test, STP-46G021, and drywell entry. The maintenance and surveillance test was satisfactorily performed. During the drywell inspection at a reactor pressure of 400 psig, the licensee identified minor steam leakage from under two flange bolts on two additional safety/relief valves, PSV-4406 and 4407. The licensee also identified minor packing gland leakage on MO-1908 (RHR Shutdown Cooling Suction Valve) and MO-2238 (HPCI Inboard Isolation Valve). The licensee determined that the leakage was acceptable and proceeded with plant startup.

During the drywell inspection, the inspector accompanied the licensee and observed that the drywell housekeeping/cleanliness had been improved.

No violations or deviations were identified in this area.

6. Monthly Surveillance observation (61726)

The inspectors observed technical specifications required surveillance testing and verified that testing was performed in accordance with adequate procedures, that test instrumentation was calibrated, that limiting conditions for operation were met, that removal and restoration of the affected components were accomplished, that test results conformed with technical specifications and procedure requirements and were reviewed by personnel other than the individual directing the test, and that any deficiencies identified during the testing were properly reviewed and resolved by appropriate management personnel.

The inspectors also witnessed portions of the following test activities:

MAT (DCP-1430) - Swing Bus Modification

STP-43C001 - Scram Time Testing

STP-45E001-PM - RCIC System Operability Tests Following Pump Maintenance

STP-42C001-M - APRM Instrument Functional Test and Calibration

STP-42B028-M - HPCI Steam Supply Low Pressure Functional Test/Calibration

STP-41A007 - Turbine Control Valve Fast Closure Response Time Test and RPI Initiate Logic

STP-46G021 - Class 1 System Leakage Test on PSV-4402

STP-46D004 - Automatic Depressurization System Relief Valve Test

STP-415E001-D - Radiation Monitor Source Checks

STP-415F001-W - Airborne Effluent Sampling - Weekly

STP-42B011-SA - LPIC Trip System Logic Functional Test and Timer Calibration

No violations or deviations were identified in this area.

7. Plant Trips (93702)

Following the plant trip on January 18, 1989, the inspectors ascertained the status of the reactor and safety systems by discussions with licensee personnel concerning plant parameters, emergency system status and reactor coolant chemistry. The inspectors reviewed the corrective actions taken by the licensee.

All systems responded as expected, and the plant was returned to operation on January 24, 1989.

No violations or deviations were identified in this area.

8. Plant Startup From Refueling/Startup Testing-Refueling (72711) (72700)

The inspectors observed control room operations, reviewed applicable logs, and conducted discussions with control room operators during the performance of the plant startup from refueling. The inspectors verified surveillance tests required during the startup were accomplished, reviewed tagout records, and verified applicability of containment integrity. Tours of the drywell and other accessible areas were made to make independent assessments of equipment conditions, plant conditions, radiological controls, safety, and adherence to regulatory requirements and to verify that maintenance requests had been initiated for equipment in need of maintenance. The inspectors, by observation and direct interview, verified that the enhanced security plan was being implemented in accordance with the licensee's commitments.

Before plant startup, the inspectors performed a walkdown of appropriate portions of the following systems disturbed during the refueling outage and independently ascertained that they have been returned to service in accordance with approved procedures.

Residual Heat Removal System

Core Spray System

Safety Relief Valves

'B' Diesel Generator

4160 and 480 Volt Electrical Systems

High Pressure Coolant Injection System

The inspectors observed/reviewed the tests listed below and verified that plant startup, heatup, approach to criticality, and core physics tests were conducted in accordance with technically adequate and approved procedures and that the facility was being operated within licensee limits.

STP-43C001-RF - Scram Insertion Time Test

STP-4313003-SP - RSCS and Rodworth Minimizer Capability Test

STP-42F007 - APRM Gain Adjust Calibration

STP-42C001-M - APRM Instrument Functional Test and Calibration

On December 24, 1988, the licensee commenced a reactor startup from an extended refueling outage. The reactor was made critical at 7:27 p.m. (CST). During this startup the licensee experienced several difficulties which subsequently prolonged the startup. The specific problems are discussed in Section 3.

No violations or deviations were identified in this area.

9. Installation and Testing of Modifications (37828)

The inspector observed installation and testing of the Low Pressure Coolant Injection (LPCI) Swing Bus Modification (DCP-1430) to correct the LPCI swing bus deficiency.

The design change was installed to correct an identified design flaw in the transfer scheme of the LPCI swing bus that provides power to the LPCI System valves. The design flaw was such that a loss of one division of 125 VDC control power (a Single Failure), could result in a total loss of LPCI capability following a design basis accident (i.e., LOCA coincident with loss of off-site power). This item was previously addressed as an Unresolved Item (331/88004-01(DRP)) and was the subject of a Confirmatory Action Letter (CAL-RIII-88-025). To correct the design flaw the licensee replaced the existing swing bus transfer breakers (52-3401 and 52-4401) with new breakers containing DC undervoltage trip devices. The DC undervoltage trip device allows opening of the transfer breakers upon a loss of DC control power and allows a swing bus transfer to occur.

The inspector verified that the design change was made in accordance with 10 CFR 50.59; that the design change was reviewed in accordance with technical specifications and the established Quality Assurance program; that the design change was conducted in accordance with written procedures, and acceptance test procedures which defined acceptance values or acceptance standards; that test records verified performance of equipment modified to technical specifications/FSAR requirements and performance of modified equipment was reviewed and approved; that operating procedures modifications were made and approved in accordance with technical specifications; that installation procedures were adequate for the identified function; that as-built drawings were changed to reflect the modifications; and that records of the design change was maintained as described in 10 CFR 50.59 and the established QA program.

Subsequent to installation of DCP-1430, Swing Bus Modification, the inspector observed Modification Acceptance Testing for DCP-1430. The testing was performed to:

1) Verify proper transfer of Division II DC control power to breakers 1B303 and 1B3401

2) Verify proper functioning of breaker 1B3401 and 1B4401, including undervoltage trip on loss of control power voltage, local and remote handswitch controls

3) Verify proper automatic transfer and interlock functions for swing bus breakers 1B3401 and 1B4401

4) Verify automatic transfer of swing bus on loss of 1B3 or 1B4

This testing was performed satisfactory with no problems identified.

No violations or deviations were identified in this area.

10. Confirmatory Action Letter (92703)

a. (Closed) Confirmatory Action Letter (CAL-RIII-88-025):

Confirmatory Action Letter CAL-RIII-88-025, dated September 2, 1988, was issued to Iowa Electric Light and Power to confirm the licensees course of action to correct a design deficiency on the Low Pressure Coolant Injection (LPCI) Swing bus. This design deficiency concerned a Single Failure of the DC control power in one division preventing an automatic transfer of the swing bus to its alternate AC power source. The subsequent loss of AC power supply to the swing bus would cause a loss of the capability of all four LPCI pumps; i.e., no LPCI function.

As described in the CAL, the licensee agreed to complete action to correct the deficiency prior to the Cycle 10 startup. This consisted of developing a design change in the LPCI swing bus select logic to accommodate the loss of either division of the 125 VDC power sources.

To correct the design flaw the licensee replaced the existing swing bus transfer breakers with new breakers containing DC undervoltage trip devices. The DC undervoltage trip device allows opening of the transfer breakers upon loss of the DC control power and allows a swing bus transfer to occur. As described in Paragraph 9, the licensee has completed installation and testing of the modification to accommodate the loss of either division of the 125 VDC power sources. This action was completed prior to Cycle 10 startup of December 24, 1988.

The above described action completes the necessary steps for closure of the confirmatory action letter.

11. Cold Weather Preparations (72714)

The inspector verified that the licensee has a procedure to prepare for cold weather operation, Integrated Plant Operating Instruction (IPOI-6). The inspector independently verified that the procedure was being implemented. The IPOI-6 includes a winterization checklist with applicable documents delineating specific responsibilities to each department. Select items in this check list were reviewed, including a surveillance procedure on freeze proof testing on fire hydrants. The licensee has performed these tests, but the IPOI-6 checklist could not be located. Subsequent to the inspection period the licensee was able to locate the completed checklist.

No violations or deviations were identified in this area.

12. Verification of Containment Integrity (61715)

The inspectors verified that the licensee, through technically adequate and approved procedures, had established containment integrity prior to commencing heatup of the reactor coolant system above 200 degree F. The inspectors, through local observation, verified the proper positioning of electrical or mechanical barriers and isolation valves associated with appropriate containment penetrations. During drywell walkdown, the inspectors verified select RHR, Core spray and HPCI valves and penetrations. The inspectors also performed a walkdown of the Standby Gas Treatment System, a system designed to mitigate contamination release in the event of a LOCA.

No violations or deviations were identified in this area.

13. Report Review (90713)

During the inspection period, the inspectors reviewed the licensee's Monthly Operating Report for November 1988. The inspectors confirmed that the information provided met the requirements of Technical Specifications 6.11.1.C and Regulatory Guide 1.16.

14. Exit Interview (30703)

The inspector met with licensee representatives (denoted in Paragraph 1) on February 2, 1989, and informally throughout the inspection period and summarized the scope and findings of the inspection activities. The inspector also discussed the likely information content of the inspection report with regard to documents or processes reviewed by the inspector. The licensee did not identify any such documents or processes as proprietary. The licensee acknowledged the findings of the inspection.